

### Remarks

This application has been carefully reconsidered in view of the Office Action of December 4, 2001. In this Amendment, corrections and changes have been made in the claims in response to the informalities noted in the Office Action and also in response to the Examiner's criticism of the use of the term "MFI-type." Specifically, claim 4 has been amended to correct the misspelling of naphtha. In addition, amendments have been made in claims 1, 12, and 13 to avoid the use of the term "MFI-type" in independent claim 1 and claims 12 and 13. Specifically, as found in independent claim 1, the claim has been amended to refer to the "MFI structure." This is believed to be consistent with commonly accepted usage in the art, which, as indicated by the Meier et al publication previously submitted in this case, designates aluminosilicate zeolites in terms of structure types. As noted previously, ZSM-5 and silicalite are MFI-structure types. Nevertheless, in order to avoid any uncertainty on this issue and to comply with the Examiner's comments, the term "type" has been deleted from the claims.

In addition to the amendments to claims 1, 4, 12, and 13, new claims 15-22 are presented herewith. While as discussed below, applicants would respectfully disagree with the Examiner's position that the process involving the use of the catalyst as set forth in claim 1 is not distinguishable from the process disclosed in the '060 reference, new claims 15-22 clearly specify process limitations in the process claims, which are not disclosed in or rendered obvious by the '060 reference. Independent claim 21 is similar to claim 15 and further recites the steam heating step in which the tetrahedral aluminum in the catalyst framework is reduced to form amorphous alumina in the pores of the catalyst. This is followed by the treatment with the complexing agent to remove the amorphous alumina from the pores of the catalyst framework. Claim 22 depends from claim 21 and recites that the steaming step is carried out at a temperature

within the range of 425°-870°C. Support for independent claim 21 is found in the paragraph bridging pages 13 and 14 of applicants' specification. Support for the dependent claim 21 is found in the paragraph bridging pages 16 and 17 of applicants' specification.

Referring first to independent claim 1, it is noted that this claim recites a propylene production process to provide a propylene yield on an olefin basis of from 30-50% based upon the feedstock olefin content employing a steamed and dealuminated catalyst of the MFI structure in which the pretreatment increases the silicon/aluminum atomic ratio to a value within the range of 180 to 1000. First, with respect to the catalyst employed in the claimed process, it is noted that claim 1 is not a product-by-process claim but, instead, is a process claim that defines the catalyst used in terms of the pretreatment process. With respect to the decisions in *In re Marosi et al* and *In re Thorpe* cited in the Office Action, it is noted that these decisions stand for the proposition that, if a product recited in a product-by-process claim is not different from (or obvious in view of) a product found in the prior art, patentability cannot be imparted to the product by the process steps. Thus, the decision in *In re Marosi et al* states as 218 USPQ 292, 293:

Where a product-by-process claim is rejected over a prior art product that appears to be identical, although produced by a different process, the burden is upon the applicants to come forward with evidence establishing an unobvious difference between the claimed product and the prior art product. (Citing cases)

Here, there the Examiner has provided no reasoning or analysis of the '060 reference to suggest that the catalyst disclosed there appears to be identical to the catalyst employed in applicants' process. In fact, among the various catalysts disclosed in '060, those that could be considered to be an MFI catalyst, ZSM-5 and silicalite, either are not characterized in terms of the silicon/aluminum ratio or, in the case of silicalite, are characterized by a silicon/aluminum ratio

of infinity - - that is, no aluminum present. Clearly, insofar as an MFI crystalline catalyst is involved, the disclosure in EP '060 would suggest to one of ordinary skill in the art that the silicon/aluminum ratio is of no significance, and in fact, aluminum need not even be present in the catalyst. In any event, clearly the silicon/aluminum ratio will be well in excess of the upper limit of 1000 called for in applicants' claims. Further, it is also clear that there is absolutely no disclosure in EP '060 which would anticipate the use of a steamed and dealuminated catalyst as called for in applicants' claims 1, 15, and 20. The use of such a catalyst would not be inherent in EP '060 under the standards for inherency as discussed below. Further, there is nothing in EP '060 which would establish a *prima facie* case of obviousness, and even if established, such a case would clearly be rebutted by applicants' experimental work, as discussed below.

As has been noted previously in prosecution of this application, EP '060 further fails to disclose a process carried out to provide a propylene yield of from 30-50 wt.% based upon the olefin content of the feedstock. With respect to the comments on this issue found in page 4 of the Office of the Action, it is noted in the first instance that the '060 patent is not in all cases "silent about the relative percentages of propylene in the product effluent." While EP '060 does not address the propylene yield in terms of the olefinic content of the feedstock, this is shown in one example. Example 36 shows the results of experimental work carried out employing Silicalite I as the catalyst and a feedstock of a 50/50 mixture of cis-butene-2 and trans-butene-2 over a period of 120 hours. While the silicon/aluminum atomic ratio of the Silicalite 1 of Example 36 is not given, it is noted that in the other examples employing silicalite, the silicon/aluminum ratio was necessarily greater than 1000. The results of Example 36 are presented in Fig. 1 of EP '060. As indicated there, the propylene content of the converted feed, as indicated by the selectivity to propylene, is less than 30% over the life of the run. The

conversion of the olefinic feed ranges from about 68% to a maximum of about 80% initially and generally is about 75% until it starts to fall off after about 80 hours on stream. Throughout the test run, the propylene content (the product of conversion and selectivity) is clearly less than 25% based upon the olefinic content of the feedstock, which, of course, is 100%. Thus, based upon the data presented in Example 36, the conclusion clearly is that the propylene content is below the 30-50% range called for in applicants' claims.

Thus, the data presented in Example 36 of EP '060 clearly shows that the claimed propylene yield, like the use of a steamed and dealuminated catalyst, is not found in EP '060. To the extent that the Examiner's rejection is based upon an argument of inherency, applicants would respectfully note that the law is well settled that for an alleged inherent feature to result from a prior art teaching, it is necessary that this inherent feature necessarily flow from the teachings of the prior art. Thus, an alleged inherent feature must be a necessary result and not merely a possible result. This principle is stated in MPEP Section 2112:

The fact that a certain result or characteristic may occur or be present in the prior art is not sufficient to establish the inherency of that result or characteristic. (Emphasis original)

Section 2112 reflects the general rule that for inherency to reside, it must be shown that the alleged inherency is necessarily present and not a mere possibility. Thus, as stated by the Board in *Ex parte Keith*, 154 USPQ 321 (Bd. of App. 1966), in reversing the Examiner's rejection based upon inherency:

There are other possible courses the reaction could follow . . . Asserted inherency must be a necessary result and not merely a possible result.

As indicated in Section 2112, this principle was more recently followed by the Board in *Ex parte Levy*, 17 USPQ2d 1461 (Bd. of App. and Interf. 1990), where the Board reversed an inherency rejection, stating as follows:

In relying upon the theory of inherency, the examiner must provide a basis in fact and/or technical reasoning to reasonably support the determination that the alleged inherent characteristic necessarily flows from the teachings of the prior art (citing cases). (Emphasis original).

Here, the issue presented by the rejection based upon EP '060 is not only the requirement for a propylene yield of 30-50% but also the requirement that the catalyst employed in the cracking process be one which is pretreated by steaming and dealumination with a complexing agent for aluminum wherein the silicon/aluminum atomic ratio of the catalyst is from 180 to 1000. This combination of features is not disclosed or suggested in the EP '060 reference, and it is clearly not inherent therein.

In addition to the foregoing arguments, which are applicable to all of the claims, applicants would respectfully submit that each of claims 2, 3, and 4 are directed to use of feedstocks in applicants' invention that are not disclosed or suggested in EP '060. It is noted that EP '060 discloses in the paragraph bridging pages 3 and 4 the treatment of the output from a catalytic cracking unit for use as the feedstock in the conversion process. Apparently, in this case the feedstock would be subjected to an oligomerization procedure to produce a feed stream of C<sub>5</sub>-C<sub>8</sub> olefins and C<sub>4</sub>+ paraffins. It is respectfully submitted that this disclosure would not suggest or render obvious the use of the specific feedstocks specified in dependent claims 2, 3, and 4. It is noted that the comments found on page 5 of the Office Action respecting these claims appear to be directed to applicants' disclosure and not the disclosure found in EP '060. The fact that EP '060 does not specifically exclude the feedstocks as claimed does not, without more, establish obviousness of the claimed subject matter.

Dependent claim 5 calls for at least 95% of the  $C_3$  compounds in the effluent to be propylene. Again referring to Example 36 as discussed above, it is noted that Fig. 1 discloses data over the course of the run for selectivity to liquids ( $C_5$  and greater) and selectivity to saturated gases which presumably would include gases of less than  $C_5$ , specifically including propane. The selectivity to propylene is over most of the run about 7 to 8 times the selectivity to saturated gases, and thus it is clear that saturated  $C_3$  content of the effluent could be well in excess of 5%, leaving the propylene content at less than 95%.

Applicants' dependent claim 6 specifies that the feedstock contacts the catalyst at an inlet temperature of 500-600°C, and claim 7 depends from claim 6 and specifies an inlet temperature of 540-580°C. Dependent claim 9 specifies that the feedstock contacts the catalyst or is passed over the catalyst at a liquid hourly space velocity (LHSV) of from 10-30  $h^{-1}$ . EP '060 does not disclose or suggest this particular combination of parameters and instead discloses, in addition to the very broad range of the silicon/aluminum ratio, broad ranges of olefin partial pressure, space velocity, and temperature. As acknowledged in the Office Action, EP '060 disclosed a temperature of 400-600°C and a space velocity of 5-200  $hrs.^{-1}$ . Thus, while EP '060 discloses broad ranges of these parameters within which more specific values could be selected, the particular combination of the silicon/aluminum atomic ratio with the inlet temperature, as specified in claims 6 and 7, and space velocity, as set forth in claim 9, can be arrived at only by selecting these values from the broad ranges in EP '060 based upon applicants' disclosure. In fact, with respect to space velocity as set forth in dependent claim 9, the only qualification of space velocity as described in EP '060 appears to be that the space velocity should be less than 50  $hrs.^{-1}$  if the pressure is atmospheric and greater than 50  $hrs.^{-1}$  at a pressure of from 1.5 to 7.5 atmospheres. As a practical matter, EP '060 suggests as a whole that the space velocity should

be outside the 10-30 hrs.<sup>-1</sup> range specified in applicants' dependent claim 9. An exception to this is found in the aforementioned Example 36 of EP '060, but here a silicon/ aluminum atomic ratio of infinity (silicalite totally free of aluminum), rather than within the range of 180 to 1000, and a propylene yield well below the 30-50% value as called for in applicants' claims, are involved. There is simply nothing in EP '060 which discloses or renders obvious the combination of silicon/aluminum ratio, propylene yield, and space velocity as called for in the claims as indicated above.

As noted previously, there is nothing to support any sort of a *prima facie* finding that the applicants' process employing the catalyst as claimed there is the same as the olefin cracking process disclosed in EP '060 employing the catalyst found in the reference disclosure. Assuming the contrary, it is noted that the data in appellants' specification clearly shows the presence of unexpected results stemming from the use of a catalyst as required in claim 1. In this regard, attention is respectfully invited to a comparison of Example 1 (with results reported in Table 1, page 25, and Fig. 1) and Example 10 (with results reported in Fig. 2). In Example 1, the silicalite catalyst having a silicon/aluminum ratio of 220 was subject to a steaming and dealumination extraction procedure employing EDTA to increase the silicon/aluminum ratio from 220 to 280. As indicated, the catalyst exhibited good stability to propylene yield over a test period of 325 hours. In contrast, in Example 10 the result was a much more dramatic decrease in activity over a slightly shorter period of time employing a silicalite catalyst which was the same as the starting catalyst (silicon/aluminum ratio of 220) subject to the steaming and dealumination step and used in Example 1. Similar good results resulting from the use of silicalite catalyst subject to steaming and dealumination are shown in other examples set forth in appellants' specification. For example, Example 8, with the results reported in Table 12a shows the results of cracking of a

butene-containing feedstock employing a steamed and dealuminated silicalite following the procedure of Example 4 and having a silicon/aluminum atomic ratio of 180. As indicated in Table 12a, at 164 hours the propylene yield showed absolutely no degradation from measurements taken at 20 hours. This result may be contrasted with the results shown in Tables 12b and 12c, respectively, for the starting silicalite catalyst and the starting silicalite catalyst steamed but not subject to extraction. As set forth in Tables 12b and 12c, the propylene yield fell off rapidly at 169 hours in Table 12b and showed a substantial decline also in Table 12c.

The comments found in the Office Action under "Response to Arguments" have been carefully considered but appear to misconstrue the experimental data discussed above. In fact, unexpected results are clearly shown by the pretreatment process involving steaming and dealumination. To reject the comparative experimental work because the catalyst before steaming and dealumination does not have the same silicon/aluminum ratio as that found after steaming and dealumination simply misconstrues the purpose of the experimental work and also the nature of applicants' invention. The very purpose of the experimental work is to show that applicants' invention, which involves steaming and dealumination to increase the silicon/aluminum atomic ratio, enhances the propylene yield over an extended period of time. Clearly, the comparison to be made is with respect to MFI-type silicate catalysts, one not subject to steaming and dealumination, and the other subject to this procedure as required in applicants' claims.

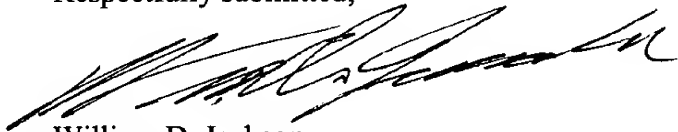
Turning now to new claims 15-22, it is noted that these claims are presented in a format, which requires as part of the claimed process the steaming and dealumination step. As noted previously, the EP '060 references fails totally to disclose any such process, and there is



absolutely nothing in the reference which would suggest the claimed processes to one of ordinary skill in the art.

Enclosed is a check in the amount of \$110 to cover the fee for a one-month extension for response to the December 4, 2001, Office Action. The response was due March 4, 2002, but with this one-month extension, the response period has been extended to April 4, 2002. The Commissioner is hereby authorized to charge any fee which may be due in connection with this Amendment to our Deposit Account No. 12-1781.

Respectfully submitted,



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Attachment to Amendment to December 4, 2001, Office Action:

In the Claims

Claims 1, 4, 12, and 13 have been amended as follows:

1. (Third Amend.) A process for the production of propylene from an olefinic feedstock containing at least one olefin of C<sub>4</sub>, or greater, the process comprising contacting the olefinic feedstock with a catalyst of the [MFI-type] **MFI structure** having a silicon/aluminum atomic ratio of from 180 to 1000 to produce an effluent containing propylene, the propylene yield on an olefin basis being from 30 to 50% based on the olefinic content of the feedstock, wherein the catalyst has been pretreated by heating the catalyst in steam and de-aluminating the catalyst by treating the catalyst with a complexing agent for aluminum, the pretreatment increasing the silicon/aluminum atomic ratio of the catalyst to a value from 180 to 1000.

4. A process according to claim 1, wherein the feedstock is selected from the group consisting of a C<sub>5</sub> cut from a steam cracker and light cracked [naptha] **naphtha**.

12. (Amended) A process according to claim 1, wherein the catalyst of the [MFI-type] **MFI structure** is [of the] silicalite[ type].

13. (Amended) A process according to claim 1, wherein the catalyst of the [MFI-type] **MFI structure** is [of the] ZSM-5[ type].